

## CLAIMS

1. A white color organic electroluminescence device comprising:

a cathode;

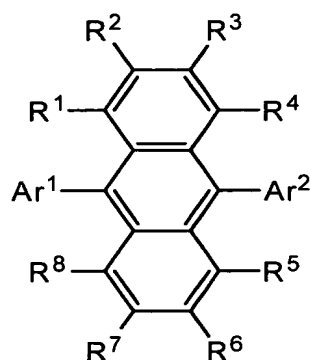
an anode; and

one or more organic thin film layers sandwiched between the two electrodes and including at least a light emitting layer, wherein the light emitting layer has a laminate comprising a bluish color light emitting layer and a yellow-to-reddish color light emitting layer; and the light emitting layer comprises an asymmetric compound containing a condensed ring.

2. A white color organic electroluminescence device according to claim 1, wherein the light emitting layer consists of the bluish color light emitting layer and the yellow-to-reddish color light emitting layer.

3. A white color organic electroluminescence device according to claim 1, wherein the bluish color light emitting layer comprises a bluish color host material and a bluish color dopant, and the bluish color host material comprises an asymmetric compound containing a condensed ring.

4. A white color organic electroluminescence device according to claim 1, wherein the asymmetric compound containing a condensed ring comprises an asymmetric anthracene-based compound represented by the following general formula (I):

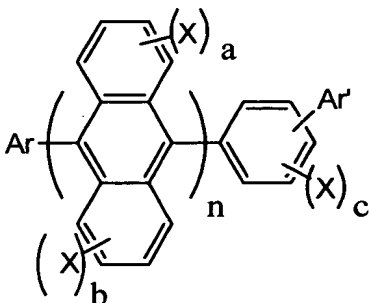


(I)

wherein Ar<sup>1</sup> and Ar<sup>2</sup> each independently represent a substituted or unsubstituted aryl group having 6 to 50 nuclear carbon atoms, provided that Ar<sup>1</sup> and Ar<sup>2</sup> do not have the same structure; and R<sup>1</sup> to R<sup>8</sup> each independently represent a hydrogen atom, a substituted or unsubstituted aryl group having 6 to 50 nuclear carbon atoms, a substituted or unsubstituted aromatic heterocyclic group having 5 to 50 nuclear atoms, a substituted or unsubstituted alkyl group having 1 to 50 carbon atoms, a substituted or unsubstituted alkoxy group having 1 to 50 carbon atoms, a substituted or unsubstituted aralkyl group having 6 to 50 carbon atoms, a substituted or unsubstituted aryloxy group having 5 to 50 nuclear atoms, a substituted or unsubstituted arylthio group having 5 to 50 nuclear

atoms, a substituted or unsubstituted alkoxy carbonyl group having 1 to 50 carbon atoms, a carboxyl group, a halogen atom, a cyano group, a nitro group, or a hydroxyl group.

5. A white color organic electroluminescence device according to claim 1, wherein the asymmetric compound containing a condensed ring comprises an asymmetric anthracene-based compound represented by any one of the following general formulae (II) to (IV):



(II)

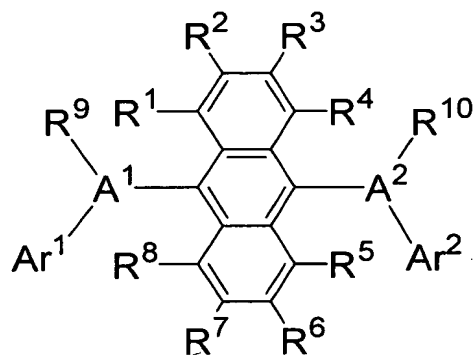
wherein Ar represents a substituted or unsubstituted fused aromatic ring residue having 10 to 50 nuclear carbon atoms;

Ar' represents a substituted or unsubstituted aryl group having 6 to 50 nuclear carbon atoms, and the number of Ar's may be two or more;

X represents a substituted or unsubstituted aryl group having 6 to 50 nuclear carbon atoms, a substituted or unsubstituted aromatic heterocyclic group having 5 to 50 nuclear atoms, a substituted or unsubstituted alkyl group having 1 to 50 carbon atoms, a substituted

or unsubstituted alkoxy group having 1 to 50 carbon atoms, a substituted or unsubstituted aralkyl group having 6 to 50 carbon atoms, a substituted or unsubstituted aryloxy group having 5 to 50 nuclear atoms, a substituted or unsubstituted arylthio group having 5 to 50 nuclear atoms, a substituted or unsubstituted alkoxycarbonyl group having 1 to 50 carbon atoms, a carboxyl group, a halogen atom, a cyano group, a nitro group, or a hydroxyl group; and

**a**, **b**, and **c** each represent an integer of 0 to 4, and **n** represents an integer of 1 to 3;

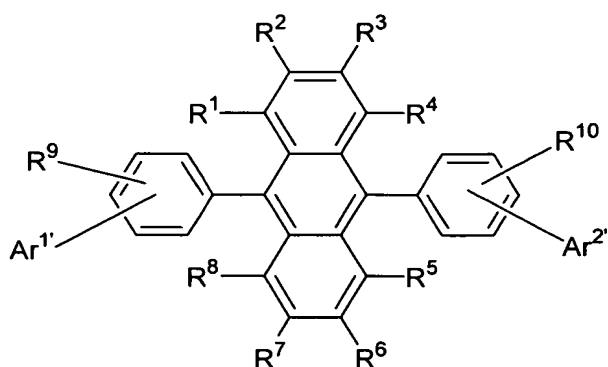


(III)

wherein A<sup>1</sup> and A<sup>2</sup> each independently represent a substituted or unsubstituted fused aromatic ring residue having 10 to 20 nuclear carbon atoms;

Ar<sup>1</sup> and Ar<sup>2</sup> each independently represent a hydrogen atom, or a substituted or unsubstituted aryl group having 6 to 50 nuclear carbon atoms, and each of the number of Ar<sup>1</sup>s and the number of Ar<sup>2</sup>s may be two or more; and

$R^1$  to  $R^{10}$  each independently represent a hydrogen atom, a substituted or unsubstituted aryl group having 6 to 50 nuclear carbon atoms, a substituted or unsubstituted aromatic heterocyclic group having 5 to 50 nuclear atoms, a substituted or unsubstituted alkyl group having 1 to 50 carbon atoms, a substituted or unsubstituted alkoxy group having 1 to 50 carbon atoms, a substituted or unsubstituted aralkyl group having 6 to 50 carbon atoms, a substituted or unsubstituted aryloxy group having 5 to 50 nuclear atoms, a substituted or unsubstituted arylthio group having 5 to 50 nuclear atoms, a substituted or unsubstituted alkoxycarbonyl group having 1 to 50 carbon atoms, a carboxyl group, a halogen atom, a cyano group, a nitro group, or a hydroxyl group, and each of the number of  $R^9$ s and the number of  $R^{10}$ s may be two or more, provided that no symmetrical group binds to each of 9-position and 10-position of central anthracene;



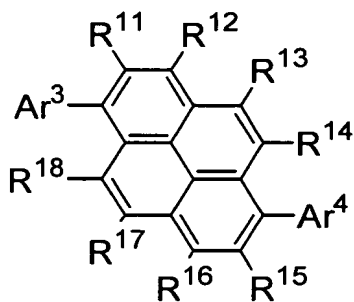
(IV)

wherein  $Ar^{1'}$  and  $Ar^{2'}$  each independently represent a substituted

or unsubstituted aryl group having 6 to 50 nuclear carbon atoms, and each of the number of Ar<sup>1</sup>'s and the number of Ar<sup>2</sup>'s may be two or more; and

R<sup>1</sup> to R<sup>10</sup> each independently represent a hydrogen atom, a substituted or unsubstituted aryl group having 6 to 50 nuclear carbon atoms, a substituted or unsubstituted aromatic heterocyclic group having 5 to 50 nuclear atoms, a substituted or unsubstituted alkyl group having 1 to 50 carbon atoms, a substituted or unsubstituted alkoxy group having 1 to 50 carbon atoms, a substituted or unsubstituted aralkyl group having 6 to 50 carbon atoms, a substituted or unsubstituted aryloxy group having 5 to 50 nuclear atoms, a substituted or unsubstituted arylthio group having 5 to 50 nuclear atoms, a substituted or unsubstituted alkoxycarbonyl group having 1 to 50 carbon atoms, a carboxyl group, a halogen atom, a cyano group, a nitro group, or a hydroxyl group, and each of the number of R<sup>9</sup>'s and the number of R<sup>10</sup>'s may be two or more, provided that no symmetrical group binds to each of 9-position and 10-position of central anthracene.

6. A white color organic electroluminescence device according to claim 1, wherein the asymmetric compound containing a condensed ring comprises an asymmetric pyrene-based compound represented by the following general formula (V):

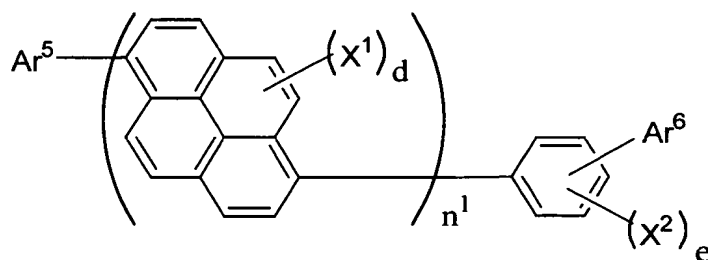


(V)

wherein Ar<sup>3</sup> and Ar<sup>4</sup> each independently represent a substituted or unsubstituted aryl group having 6 to 50 nuclear carbon atoms, provided that Ar<sup>3</sup> and Ar<sup>4</sup> do not have the same structure; and R<sup>11</sup> to R<sup>18</sup> each independently represent a hydrogen atom, a substituted or unsubstituted aryl group having 6 to 50 nuclear carbon atoms, a substituted or unsubstituted aromatic heterocyclic group having 5 to 50 nuclear atoms, a substituted or unsubstituted alkyl group having 1 to 50 carbon atoms, a substituted or unsubstituted alkoxy group having 1 to 50 carbon atoms, a substituted or unsubstituted aralkyl group having 6 to 50 carbon atoms, a substituted or unsubstituted aryloxy group having 5 to 50 nuclear atoms, a substituted or unsubstituted arylthio group having 5 to 50 nuclear atoms, a substituted or unsubstituted alkoxycarbonyl group having 1 to 50 carbon atoms, a carboxyl group, a halogen atom, a cyano group, a nitro group, or a hydroxyl group.

7. A white color organic electroluminescence device according

to claim 1, wherein the asymmetric compound containing a condensed ring comprises an asymmetric pyrene-based compound represented by any one of the following general formulae (VI) to (IX):



(VI)

wherein  $\text{Ar}^5$  represents a substituted or unsubstituted fused aromatic ring residue having 10 to 50 nuclear carbon atoms;

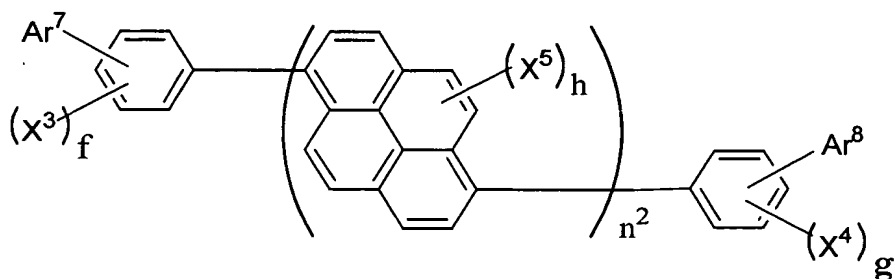
$\text{Ar}^6$  represents a substituted or unsubstituted aryl group having 6 to 50 nuclear carbon atoms, and the number of  $\text{Ar}^6$ s may be two or more;

$\text{X}^1$  and  $\text{X}^2$  each independently represent a substituted or unsubstituted aryl group having 6 to 50 nuclear carbon atoms, a substituted or unsubstituted aromatic heterocyclic group having 5 to 50 nuclear atoms, a substituted or unsubstituted alkyl group having 1 to 50 carbon atoms, a substituted or unsubstituted alkoxy group having 1 to 50 carbon atoms, a substituted or unsubstituted aralkyl group having 6 to 50 carbon atoms, a substituted or unsubstituted aryloxy group having 5 to 50 nuclear atoms, a substituted or unsubstituted arylthio group having 5 to 50 nuclear atoms, a substituted or unsubstituted alkoxycarbonyl group having 1 to 50 carbon atoms, a carboxyl group, a halogen atom, a cyano group, a nitro group,



or a hydroxyl group; and

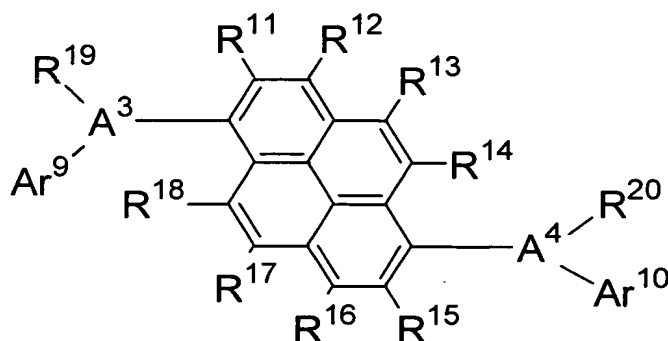
**d** represents an integer of 0 to 8, **e** represents an integer of 0 to 4, and  $n^1$  represents an integer of 1 to 3;



(VII)

wherein  $Ar^7$  and  $Ar^8$  each independently represent a substituted or unsubstituted aryl group having 6 to 50 nuclear carbon atoms, and each of the number of  $Ar^7$ 's and the number of  $Ar^8$ 's may be two or more;  $X^3$ ,  $X^4$ , and  $X^5$  each independently represent a substituted or unsubstituted aryl group having 6 to 50 nuclear carbon atoms, a substituted or unsubstituted aromatic heterocyclic group having 5 to 50 nuclear atoms, a substituted or unsubstituted alkyl group having 1 to 50 carbon atoms, a substituted or unsubstituted alkoxy group having 1 to 50 carbon atoms, a substituted or unsubstituted aralkyl group having 6 to 50 carbon atoms, a substituted or unsubstituted aryloxy group having 5 to 50 nuclear atoms, a substituted or unsubstituted arylthio group having 5 to 50 nuclear atoms, a substituted or unsubstituted alkoxycarbonyl group having 1 to 50 carbon atoms, a carboxyl group, a halogen atom, a cyano group, a nitro group, or a hydroxyl group; and

**f** and **g** each represent an integer of 0 to 4, **h** represents an integer of 0 to 8, and  $n^2$  represents an integer of 1 to 3, provided that no symmetrical group binds to each of 1-position and 6-position of central pyrene;



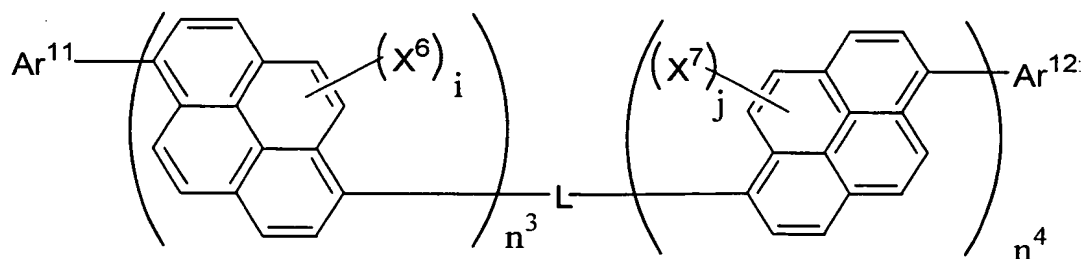
(VIII)

wherein  $A^3$  and  $A^4$  each independently represent a substituted or unsubstituted fused aromatic ring residue having 10 to 20 nuclear carbon atoms;

$Ar^9$  and  $Ar^{10}$  each independently represent a hydrogen atom, or a substituted or unsubstituted aryl group having 6 to 50 nuclear carbon atoms, and each of the number of  $Ar^9$ 's and the number of  $Ar^{10}$ 's may be two or more; and

$R^{11}$  to  $R^{20}$  each independently represent a hydrogen atom, a substituted or unsubstituted aryl group having 6 to 50 nuclear carbon atoms, a substituted or unsubstituted aromatic heterocyclic group having 5 to 50 nuclear atoms, a substituted or unsubstituted alkyl group having 1 to 50 carbon atoms, a substituted or unsubstituted alkoxy group having 1 to 50 carbon atoms, a substituted or unsubstituted

aralkyl group having 6 to 50 carbon atoms, a substituted or unsubstituted aryloxy group having 5 to 50 nuclear atoms, a substituted or unsubstituted arylthio group having 5 to 50 nuclear atoms, a substituted or unsubstituted alkoxycarbonyl group having 1 to 50 carbon atoms, a carboxyl group, a halogen atom, a cyano group, a nitro group, or a hydroxyl group, and each of the number of R<sup>19</sup>s and the number of R<sup>20</sup>s may be two or more, provided that no symmetrical group binds to each of 1-position and 6-position of central pyrene;



(IX)

wherein Ar<sup>11</sup> and Ar<sup>12</sup> each independently represent a substituted or unsubstituted aryl group having 6 to 50 nuclear carbon atoms; X<sup>6</sup> and X<sup>7</sup> each independently represent a substituted or unsubstituted aryl group having 6 to 50 nuclear carbon atoms, a substituted or unsubstituted aromatic heterocyclic group having 5 to 50 nuclear atoms, a substituted or unsubstituted alkyl group having 1 to 50 carbon atoms, a substituted or unsubstituted alkoxy group having 1 to 50 carbon atoms, a substituted or unsubstituted aralkyl group having 6 to 50 carbon atoms, a substituted or unsubstituted aryloxy

group having 5 to 50 nuclear atoms, a substituted or unsubstituted arylthio group having 5 to 50 nuclear atoms, a substituted or unsubstituted alkoxy carbonyl group having 1 to 50 carbon atoms, a carboxyl group, a halogen atom, a cyano group, a nitro group, or a hydroxyl group;

**L** represents a substituted or unsubstituted arylene group having 6 to 50 nuclear carbon atoms, or a substituted or unsubstituted divalent aromatic heterocyclic group having 3 to 50 nuclear atoms; and

**i** and **j** each represent an integer of 0 to 8, and  $n^3$  and  $n^4$  each represent an integer of 1 to 3

8. A white color organic electroluminescence device according to claim 3, wherein the bluish color dopant comprises at least one compound selected from a group consisting of a styrylamine, an amine-substituted styryl compound, a compound containing an amine-substituted fused aromatic ring, and a compound containing a fused aromatic ring.

9. A white color organic electroluminescence device according to claim 1, comprising the anode, the bluish color light emitting layer, the yellow-to-reddish color light emitting layer, and the cathode in this order, wherein the yellow-to-reddish color light emitting layer contains the same host material as that of the bluish

color light emitting layer and a yellow-to-reddish color dopant.

10. A white color organic electroluminescence device according to claim 9, wherein the yellow-to-reddish color dopant comprises a compound having multiple fluoranthene skeletons.

11. A white color organic electroluminescence device according to claim 9, wherein the yellow-to-reddish color dopant comprises a compound having a fluorescent peak wavelength of 540 nm to 700 nm.

12. A white color organic electroluminescence device according to claim 1, wherein each of the bluish color light emitting layer and the yellow-to-reddish color light emitting layer has a thickness of 5 nm or more.